REMARKS

This responds to the Office Action mailed on October 11, 2006.

Claims 1, 8 and 12 are amended, no claims are canceled, and no claims are added; as a result, claims 1-16 are now pending in this application.

Claim Objections

Claim 1 was objected to because of a punctuation error, 4^{th} paragraph. This error has been corrected.

§101 Rejection of the Claims

Claims 1 and 12 were rejected under 35 U.S.C. § 101 because the claimed inventions ~~is~~ were alleged to be directed to non-statutory subject matter.

Claims 1 and 12 have been amended as requested in the Office Action. Applicants respectfully submit that the amended claims 1 and 12 are directed to statutory subject matter for the reasons set out below.

Amended claims 1 and 12 are directed to methods comprising operations instantiated into some physical implementation which would result in a practical application producing a concrete, useful, and tangible result.

Applicants firstly contend that the associating, representing, compressing and using claimed in claim 1, for example, are not merely broadly recited without any tangible way of implementing these operations. For example, the compressing operation is a further qualified by the language "by quantizing each RMBR to a finite precision by cutting off trailing insignificant bits after quantization", which clearly specifies a manner in which the compression operation is to be performed. With respect to the associating operation, a person skilled in the art would readily appreciate many ways in which such an association operation may be performed, and the Applicants do not intend to limit claim 1 or claim 12 to any one of these association operations in particular. Similarly, any person skilled in the art would really appreciate many ways in which a representation may be performed, and the Applicants again do not intend to limit claim 1 or claim 12 to any one of the representation operations in particular.

Further, the methods claimed in claims 1 and 12 may have a practical application, merely for example, when the methods are used to provide data structures in a computerized database system to enhance its performance. For example, by using the methods claimed in claims 1 and 12, a main memory database system, using multi-dimensional indexes, may be able to reduce index search time.

Also, it is clear that Applicants' invention claimed in claims 1 and 12 , in example embodiments, may be used to provide a cache-conscious data structure that can be employed by a computerized database system. The computer-implemented data structure is a concrete, useful and tangible result from example embodiments of inventions claimed in claims 1 and 12.

Finally, the methods claimed in amended claims 1 and 12 use a QRMBR generated as a result of the prior steps (i.e., associating, representing and compressing) to access data objects stored in the database system. This is a practical application of the claimed invention creating a useful, concrete, and tangible result.

§112 Rejection of the Claims

According to M.P.E.P. § 2173.05(e), the failure to provide explicit antecedent basis for terms does not always render a claim indefinite under 35 U.S.C. § 112. If the scope of a claim would be reasonably ascertainable by those skilled in the art, then the claim is not indefinite (citing *Ex parte Porter*, 25 USPQ2d 1144, 1145 (Bd. Pat. App. & Inter. 1992) (holding "controlled stream of fluid" provided reasonable antecedent basis for "the controlled fluid")). In applying 35 U.S.C. § 112, inherent components of elements recited have antecedent basis in the recitation of the components themselves. For example, the limitation "the outer surface of said sphere" would not require an antecedent recitation that the sphere has an outer surface. *M.P.E.P.* § 2173.05(e) (citing *Bose Corp. v. JBL, Inc.*, 274 F.3d 1354, 1359, 61 USPQ2d 1216, 1218-19 (Fed. Cir 2001) (holding that recitation of "an ellipse" provided antecedent basis for "an ellipse having a major diameter" because "[t]here can be no dispute that mathematically an inherent characteristic of an ellipse is a major diameter")).

Claim 8 was rejected under 35 U.S.C. § 112, second paragraph, for indefiniteness as claim 8 recites the limitation "the corresponding QRMBR", for which there is allegedly insufficient antecedent basis.

Claim 8 is amended to more clearly define its claimed invention. It would be reasonably ascertainable by those skilled in the art that each of generated QRMBRs (e.g., R1-R3 in Fig. 1C) corresponds to one RMBR before compressing (e.g., R1-R3 in Fig. 1B). Therefore, the limitation "a corresponding QRMBR" in amended claim 8 satisfies the requirement for sufficient antecedent basis as required by *Ex parte Porter*, *Bose Corp.* and the MPEP.

§102 Rejection of the Claims

According to M.P.E.P. § 2131, a reference must teach every element of the claim to anticipate a claim. "A claim is anticipated only if **each and every element** as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).* It is not enough, however, that the prior art reference discloses all the claimed elements in isolation. Instead, "[a]nticipation requires the presence in a single prior reference disclosure of each and every element of the claimed invention, ***arranged as in the claim***." *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984) (citing *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 220 USPQ 193 (Fed. Cir. 1983)) (emphasis added).

In addition, according to the MPEP, claim language does not necessarily have to be the same as used in the specification. The third paragraph of M.P.E.P. § 2131.05(e) states:

> The mere fact that a term or phrase used in the claim has no antecedent basis in the specification disclosure does not mean, necessarily, that the term or phrase is indefinite. **There is no requirement that the words in the claim must match those used in the specification disclosure**. Applicants are given a great deal of latitude in how they choose to define their invention so long as the terms and phrases used define the invention with a reasonable degree of clarity and precision.

Claims 1-2, 6-9, 11-14 and 16 ~~are~~ were rejected under 35 U.S.C. § 102(e) as being anticipated by Kothuri et al. (U.S. Patent No. 6,470,344: hereinafter "Kothuri").

Applicants respectfully submit that Kothuri does not anticipate claim 1-2, 6-9, 11-14 and 16 of the present application.

Kothuri describes a method for buffering nodes of a hierarchical index (e.g., R-tree, bang file, hB-tree) during operations on multi-dimensional data represented by the hierarchical index.

Kothuri, however, teaches neither using a relative representation of an MBR (RMBR) nor compressing the RMBR using a given finite level of quantization as claimed in claims 1 and 12. Claims 1 and 12 have been amended to more clearly define the claimed invention. The Office Action, therefore, has failed to show that Kothuri teaches each and every element of Applicants' claimed invention as arranged in claims 1 and 12, as required by *Verdegaal Bros.*, *Lindemann Maschinenfabrik GmbH* and the MPEP.

I. Regarding the limitation of "representing":

The Office Action states that the features upon which Applicants relies (i.e., **coordinates of the MBR represented relative to coordinates of a reference MBR**" in claim 1) are not recited in the rejected claims 1 and 12 (p. 14, lines 1-7). ~~As~~ In support of this contention, the Office Action cites *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993) (holding that although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims).

Based on the assertion as noted above, the Office Action further states that Kothuri teaches "representing an MBR by a RMBR that is coordinates of the MBR represented relative to coordinates of a reference MBR" (p. 6, lines 9-13). ~~As~~ In support of this contention, the Office Action points to Figs. 3 & 6A and col. 11, lines 47-53 of Kothuri.

Applicants disagree, first of all, with the Office Action in applying *In re Van Geuns*. Applicants respectfully submit that the features which Applicant relies are fully recited in claims 1 and 12, parts of which state:

> (claim 1 as amended) ... representing each of one or more said MBRs by a relative representation of an MBR ("RMBR"), wherein the relative representation of an MBR ("RMBR") is coordinates of the MBR represented relative to coordinates of a reference MBR;
>
> (claim 12 as amended) ... representing each of one or more said minimum bounding shapes by a relative representation, wherein the relative representation is coordinates of the minimum bounding shape represented relative to coordinates of a reference minimum bounding shape;

For example, as quoted above, claim 1 clearly states that the RMBR is coordinates of the MBR represented relative to coordinates of a reference MBR. As noted, for example, at Figs. 1B, page 7, lines 9-11 and page 12, lines 11-16 of Applicants' specification, this definition of the RMBR

is fully supported in the specification. The specification describes that an example way to calculate the relative representation of an MBR is, for example, to use coordinates of the lower left corner of its parent MBR. *Id.* As noted at Fig. 1A-1B and p. 12, lines 17-21 of Applicants' specification, the calculation process is also clearly described by Applicants.

Therefore, the limitation that "an RMBR is **coordinates of the MBR represented relative to coordinates of a reference MBR**" as recited in claim 1 is fully supported from Applicant's specification as required by MPEP. For a similar reason, the pointed feature is fully recited in claim 12 too.

Secondly, Applicants respectfully submit that Kothuri does not teach using a RMBR represented relative to coordinates of a reference MBR to represent an MBR as claimed in claims 1 and 12.

For example, under Kothuri's approach, there is no designated reference MBR used to represent relative coordinates of other MBRs. Consequently, under Kothuri's approach, other MBRs are not represented in the coordinates relative to the reference MBR. Although Kothuri states that numerals are used to represent to each of the clusters or data items in it (e.g., 302a, 320, 322, 324 and 326 in Fig. 3 and 6A, Col. 11, line 55), Kothuri does not disclose that they are relative coordinates represented relative to coordinates of a reference MBR as claimed in claim 1 of the present application.

Likewise, the numbers used in "m(11), m(5) and m(6)" in Fig. 3 of Kothuri are not relative coordinates based on the reference MBR. "m(11), m(5) and m(6)" are just symbolic representations of "Dividing Lines" (e.g.,310, 312 and 314 in Fig. 3) where a data split occurs under the VAMSplit algorithm. Specifically, "m(N)" represent an approximate median number when there are N data points in a DATASET (300) (col. 11, lines 56~63).

For example, m(11) just represents a median value for a dataset having eleven data points. The median value of six for this example is calculated by the given formula (col. 11, line 63 ~ col. 12, line 11) and is used to indicate a first dividing line. Using this median value of six as an indication of the dividing line, the first given set including eleven data points are split resulting in two groups having six and five data points respectively. Then, m(6) represents a median value for the newly split part of the dataset having six data points (left side of the dataset 300 in Fig. 3). For this time, the median value of three is calculated using the same formula

above and the already-split part having six data points splits again into other two data groups having three and three data points. And so on (col. 12, lines 12~62).

In contrast, as discussed above, claims 1 and 12 require that a relative representation of an MBR ("RMBR") is **coordinates of the MBR represented relative to coordinates of a reference MBR**. For example, as illustrated at Figs 1A-1B, an MBR (e.g., R1) in Fig. 1A with coordinates of (43153, 27087, 43160, 27095)) becomes a RMBR (e.g., R1) in Fig. 1B with coordinates of (3, 7, 10, 15). This relative representation results from using (43150, 27080), coordinates of the lower left corner of the enclosing MBR (e.g., R0 in Fig. 1A), as a reference MBR. Applicants are unable to find such a teaching in Kothuri.

II. Regarding the limitation of "compressing":

The Office Action states that Kothuri teaches "compressing each RMBR into a quantized RMBR ("QRMBR") by quantizing each RMBR to a finite precision by cutting off trailing insignificant bits after quantization" (p. 6, lines 14-19). In support of this contention, the Office Action points to col. 11, line 60 through col. 12, line 62.

Applicants respectfully submit that Kothuri does not teach compressing a RMBR into a QRBMR as claimed in amended claim 1.

The Office Action, first of all, states that Kothuri teaches compressing each RMBR. In support of this contention, the Office Action points to col. 11, line 66 of Kothuri, which states:

> **(col. 11, line 63-67)** ... If the number of data points to be divided is less than twice the fanout value (i.e., N < 2*M), an effective approximate median is equal to the floor (i.e., the truncated or rounded down) value of N divided by two (i.e., m(N) = floor(N/2))...

As noted in the discussion of the limitation "reporting" above, the cited portion simply shows how to calculate an effective approximate median value of the number of data points in a given minimum bounding rectangle. Specifically, the above portion describes a way of dividing N data points (or records) into two groups. Floor() or ceil() function should be used when N is odd. For example, if N is 5, it is not possible to store 2.5 (= 5/2) elements in each group. Instead, one group has 2 data points and the other has 3 data points. Splitting into two groups is repeatedly applied until every group can fit into a fixed size node. When each group has M or less data, the splitting is stopped.

Another portion of Kothuri further states:

> (col. 3, lines 36-40) ..In particular, when the set of data items-or a subset thereof- is too large to fit in a single leaf node, a suitable dimension/attribute by which to divide the data items is selected and the set or subset is divided accordingly. The capacity of a node may be specified as a fanout characteristic of the index or may be determined by a parameter of a suitable physical storage device (e.g., the capacity of a disk page).

As quoted above, Kothuri computes the approximate median value to find a dividing line. Then, the data points in a given set (e.g., a minimum bounding rectangle) are selected by the dividing line and the given set is divided into two subsets. Although the process of dividing the group of data points distributes the data points to a new node for efficient data access, it does not reduce the physical size of each node. Accordingly, Kothuri simply does not disclose compressing each RMBR (e.g., there is no reduction in the physical size of each node under the teachings of Kothuri). Therefore, unlike the Office Action's assertion, <u>Kothuri does not teach "compressing each RMBR"</u> as claimed by Applicants. Applicants are unable to find such a teaching in Kothuri.

Secondly, the Office Action states that Kothuri teaches "quantizing each RMBR to a finite precision." In support of this contention, the Office Action points to col. 11, line 60 through col. 12, line 62 of Kothuri.

Applicants respectfully disagree. As noted at Fig. 1C, p. 7, lines 12-13 and p. 14, lines 9-24 of Applicants' specification, Applicants teach quantizing a RMBR according to a given level of quantization (e.g., 16 levels, desired number (*l*) of quantization levels). In addition, Applicants claim quantizing a **RMBR**, which is not disclosed by Kothuri as discussed above. Therefore, <u>Kothuri does not teach quantizing a RMBR using a finite level of quantization</u> as claimed in amended claim 1. Applicants are unable to find such a teaching in Kothuri.

Finally, the Office Action states that Kothuri's 'truncate or round down' feature is equivalent to cutting off trailing insignificant bits of the RMBR under Applicants' approach (p. 14, lines 8-17). As support of this, the Office Action points to col. 11, line 64 of Kothuri as quoted above.

Applicants respectfully disagree. The cited portion of Kothuri shows that the feature 'truncate or round down' relied in the Office Action is a well-known 'floor function' in mathematics. The floor function simply gives the largest integer less than or equal to a given parameter. For example, as noted at col. 12, lines 1-33 of Kothuri, 'floor(5/2)' returns a value of

2 since 5 divided by 2 is 2.5 and 2 is the largest integer less than or equal to 2.5 (i.e., m(5) = **floor(5/2) = 2**). Therefore, 'truncating or rounding down' in Kothuri means dropping a decimal value from the value of a real number resulting from dividing the number of data points by a given number, for example, two here (e.g., dropping 0.5 from 2.5 in the example above).

Under an example of the Applicants' approach, as noted at p. 14, lines 1-6 & 24 of Applicants' specification, cutting off trailing insignificant bits is to reduce the physical bits having insignificant value as a result of the quantization of a RMBR according to a given quantization level. *See* also Fig. 5A-8B, p. 3, lines 11-13; p. 12, lines 15-16 & 22-23; and p. 13, lines 18-21 of Applicants' specification. In addition, Applicants claim cutting off bits of a **RMBR**, which is not disclosed by Kothuri as discussed above. Therefore, Kothuri's 'truncating or rounding down' is different from cutting off trailing insignificant bits of a RMBR as claimed by Applicants.

The arguments presented above with respect to claim 1 are also applicable to a consideration of independent claim 12, and the Examiner is respectfully requested to consider these arguments in connection with claim 12.

For the reasons discussed above, Kothuri does not teach a method for using a quantized relative representation of minimum bounding rectangle (QRMBR) to access data objects stored in a database, as claimed in amended claims 1 and 12. Reconsideration is respectfully requested.

With regard to dependent claims 2-11 and 13-16, these claims are patentable as being dependent on a patentable base claim. In addition, at least the following arguments apply with respect to the dependent claims:

Kothuri does not teach or suggest using internal nodes having a pointer only for the first entry as claimed in claims 6 and 13;

Kothuri does not teach or suggest storing a reference MBR in each node as claimed in claim 7;

Kothuri does not teach or suggest using the corresponding QRMBR stored in a parent node to obtain the reference MBR of a child node of the parent node as claimed in claim 8;

Kothuri does not teach or suggest using the corresponding "quantized representation" stored in a parent node to obtain the reference "minimum bounding shape" of a child node of the parent node as claimed in claim 14; and

Kothuri does not teach or suggest storing QRMBR in the internal nodes while storing MBRs in the leaf nodes as claimed in claim 9.

§103 Rejection of the Claims

Claims 3-5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kothuri as applied to claim 1 above, and further in view of Fortin et al. (U.S. 6,868,410).

Claims 3-5 are, however, patentable as being dependent on a patentable base claim.

Claim 10 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kothuri as applied to claim 1 and 12 above respectively, and further in view of "Compacting Discriminator Information for Spatial Trees by Inga Sitzmann and Peter J. Stuckey, Copyright 2001, Australian Computer Society, Inc.

Claim 10 and 15 are, however, patentable as being dependent on a patentable base claim.

CONCLUSION

Applicants respectfully submit that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicants' attorney 408-278-4042 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Reservation of Rights

In the interest of clarity and brevity, Applicants may not have addressed every assertion made in the Office Action. Applicants' silence regarding any such assertion does not constitute any admission or acquiescence. Applicants reserve all rights not exercised in connection with this response, such as the right to challenge or rebut any tacit or explicit characterization of any reference or of any of the present claims, the right to challenge or rebut any asserted factual or legal basis of any of the rejections, the right to swear behind any cited reference such as provided under 37 C.F.R. § 1.131 or otherwise, or the right to assert co-ownership of any cited reference. Applicants do not admit that any of the cited references or any other references of record are

relevant to the present claims, or that they constitute prior art. To the extent that any rejection or assertion is based upon the Examiner's personal knowledge, rather than any objective evidence of record as manifested by a cited prior art reference, Applicants timely object to such reliance on Official Notice, and reserves all rights to request that the Examiner provide a reference or affidavit in support of such assertion, as required by MPEP § 2144.03. Applicants reserve all rights to pursue any cancelled claims in a subsequent patent application claiming the benefit of priority of the present patent application, and to request rejoinder of any withdrawn claim, as required by MPEP § 821.04.

Respectfully submitted,

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__CERTIFICATE UNDER 37 CFR § 1.8:__ The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 20 day of March 2007.

Name: Dawn R. Shaw Signature: ____________________